Review of Recommended Values for Scheduling and Dispatch Policy Parameters

– Long Notice Adjustment Factor & System Imbalance Flattening Factor (LNAF and SIFF)

Report to the Regulatory Authorities

Date of Publication August 30th 2019

EIRGRID SONI

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Licence Obligation

As part of the EirGrid transmission system operator license condition 10A part 7 and the SONI transmission system operator license condition 22A part 7, we are obliged to provide a report annually or as requested by the regulators,
“The Licensee shall provide a report to the Commission on an annual basis or whenever so required by the Commission on the performance of its scheduling and dispatch process resulting from the current values of the scheduling and dispatch policy parameters. The Licensee may propose changes to the values of those policy parameters, or their replacement with different parameters. After publication of the Licensee’s report and following consultation with such persons as the Commission believes appropriate, the Commission may determine that the values of the policy parameters shall change, or that different policy parameters shall be used. Such a determination shall specify the date from which any such changes shall take effect and may specify transitional arrangements to be applied by the Licensee.”

In accordance with this license condition we are providing this report on the performance of the current scheduling and dispatch parameters for LNAF and SIFF. In this report we propose recommended values for 2020 based on operational data that we have gathered since I-SEM Go Live.

LNAF and SIFF High Level Intent

As outlined in the studies carried out into LNAF and SIFF values prior to go-live (Recommended LNAF and SIFF values), the aim of the LNAF and SIFF is to apply a weighting to the costs of offline generators and thereby reduce the propensity for taking early commitment actions in the scheduling process. This is to prevent the System Operator from taking actions on units prior to gate closure for energy balancing reasons, which could foreclose the ability of participants to trade in the still-open intraday marketplaces to reduce energy imbalances.

In the first report provided to recommend values for these parameters, values of zero were recommended and the decision used these recommended values. As part of that report, the following was stated:
"After a period of live operation, SEMO and the TSOs will carry out analysis on the results of actual market activity and system operation to consider ex-ante participation, the system shortfalls that occur, the level to which TSO actions are impacting on the intraday market relative to the size of the system shortfall and the impacts of the application of a non-zero value of LNAF. SEMO and TSOs will provide a report to the Regulatory Authorities at that point making a further recommendation with respect to the application of the SSII in the System Operator's scheduling systems to aid the implementation of a "last time to order" policy."

This review presents high level analysis carried out to evaluate the need to apply LNAF and SIFF values, and the potential risks of applying them, based on I-SEM operational data.

Ex-ante Markets

One indication that there is a need for an LNAF is whether or not there is sufficient liquidity in the intraday markets from units offering to sell. Feedback from SEMOpx including indications through Market Operator User Group meetings with the auction order books in the intraday auctions has been that there appears to be more than sufficient volumes of offers to sell to meet the bids to buy, where the total sell volumes normally exceed the total bid volumes. As can be seen from figure 1 the volumes in the Intraday markets (IDA1/ IDA2 and IDA3) represent a small percentage of that overall volume with the majority of trading executed in the Day Ahead Market (DAM).

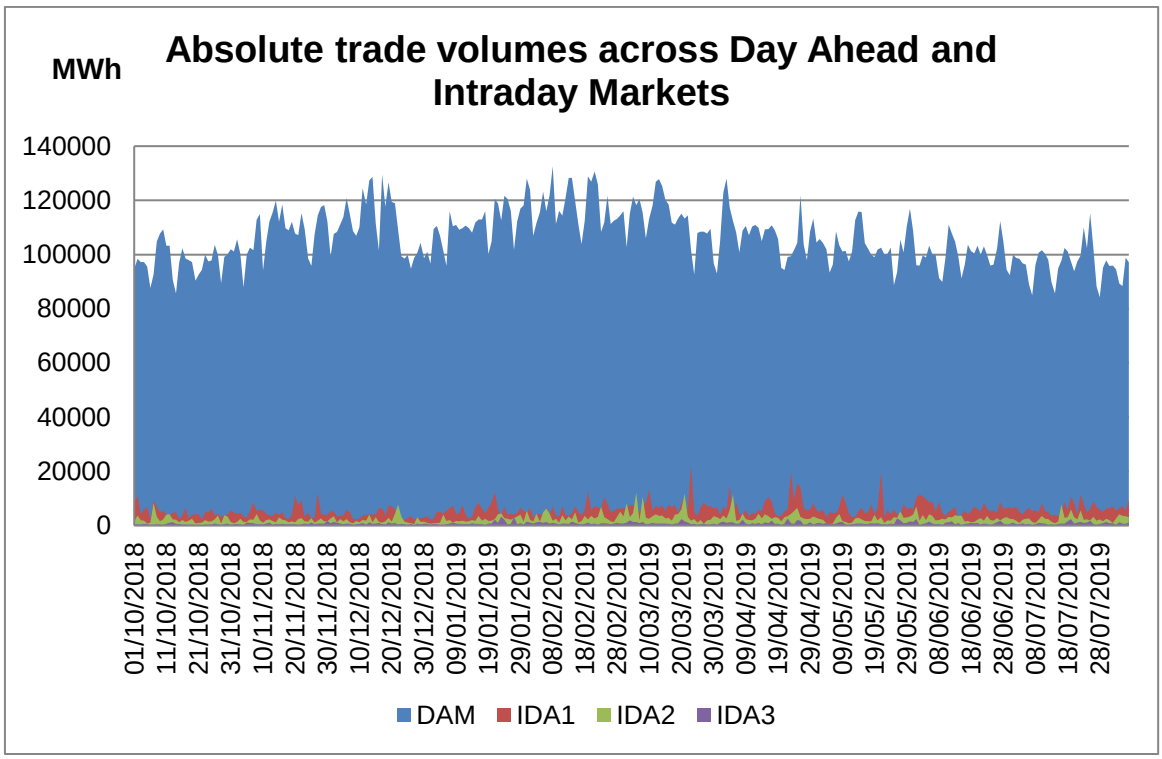

Figure 1: Traded Volumes across Intraday Markets

The volumes alone do not indicate whether or not there is liquidity at price levels which are sufficient for all of those bids to buy to clear. One means of determining if sufficient liquidity in auctions from sellers exist is if the prices from the different intraday auctions generally follow the shape and magnitude of the day-ahead market price profile (see figure 2 and figure 3). This is because with a lack of liquidity from sellers in those markets it would be expected that the price would diverge from the day-ahead market price even in circumstances of relatively benign conditions, not just in cases where events that drive trading to avoid exposure to the imbalance price. However for the majority of the time the prices in each of these markets are relatively convergent. This is indicated by the

intraday auction prices often being the same level in the same periods as the day-ahead and the profile of prices follows a similar shape to the DAM(see figure 3). There are certain days where this did not happen, in particularly around the evening peak hours, which for the majority can be explained by the actions of a single participant trading a large amount in a slightly different way, but the analysis shows that the primary trend is for convergence of prices, in particular between the DAM and IDA1 and IDA2. This analysis was based on market price/volume data which is available here.

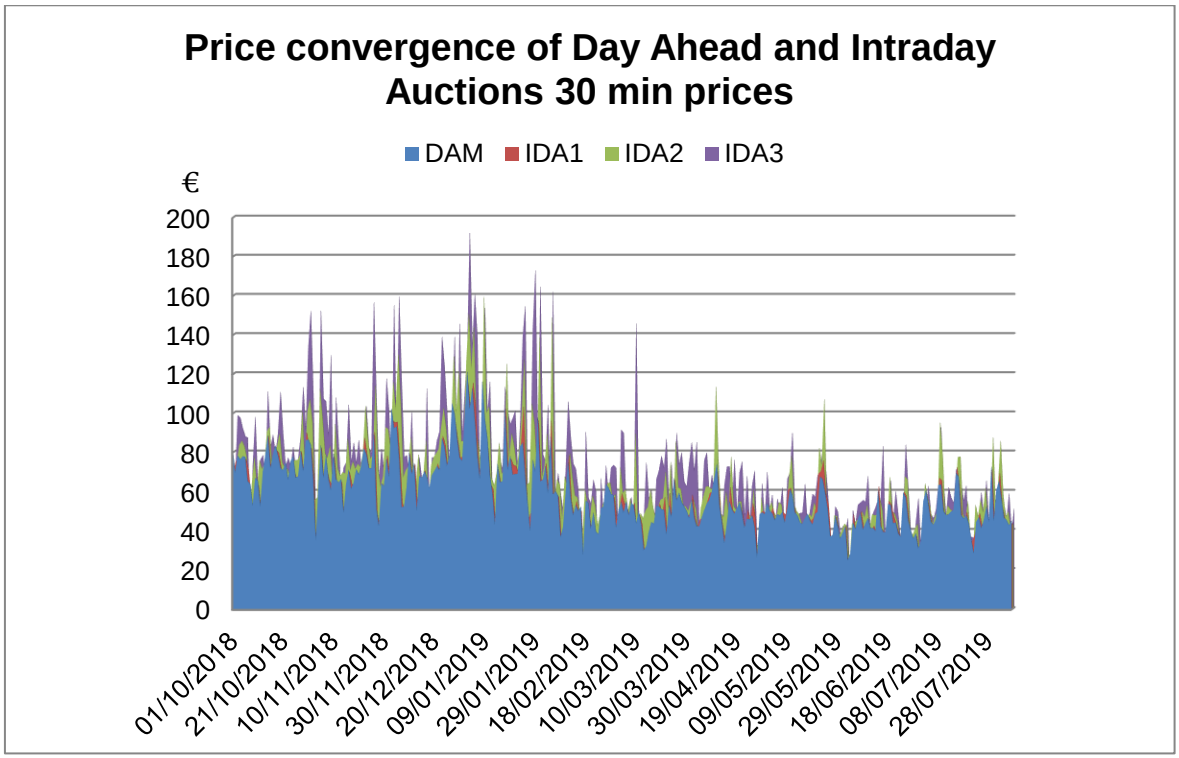

Figure 2: Price convergence between Intraday and Day Ahead Auctions 30 min spot price

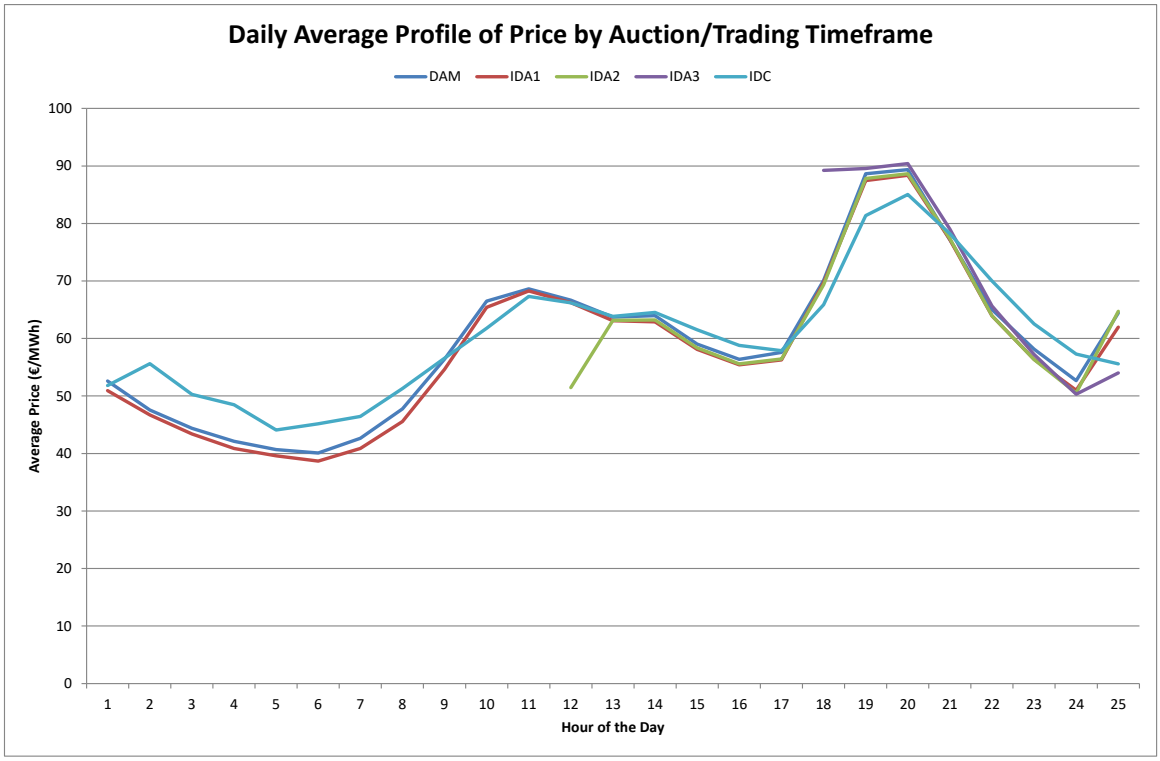

Figure 3: Price convergence between Intraday and Day Ahead Auctions based on daily average price[1]

Another indication of a need for an LNAF is whether there are major drivers of imbalances causing the market to be short in a way which is forecastable and therefore could be reasonably corrected through intraday trading. One measure of this is the extent to which purchases (bids to buy) clear in the DAM. If a bid does not clear day-ahead then this may indicate that there will be attempts to buy this volume in an intraday market. If there is a large requirement to buy then there would be an even higher need for liquidity in offers to sell in the intraday market, if there are low requirements to buy then there is less of a need for intraday offers. As per figure 4 supplier purchases have been found to clear at very high levels in the DAM, averaging approximately 97.3% with a maximum of 99.37% and a minimum of 90.8%. This indicates that the requirement for large volumes to sell in intraday is not that high given most of the required volume purchases from a major potential driver of imbalances are cleared in the DAM.

[1] Note that the outliers for IDA2 in hour 12, IDA3 for hour 13, and all values for hour 25, are due to small samples arising from clock changes. The date range for the data sample was from market go-live until 06/08/2019.

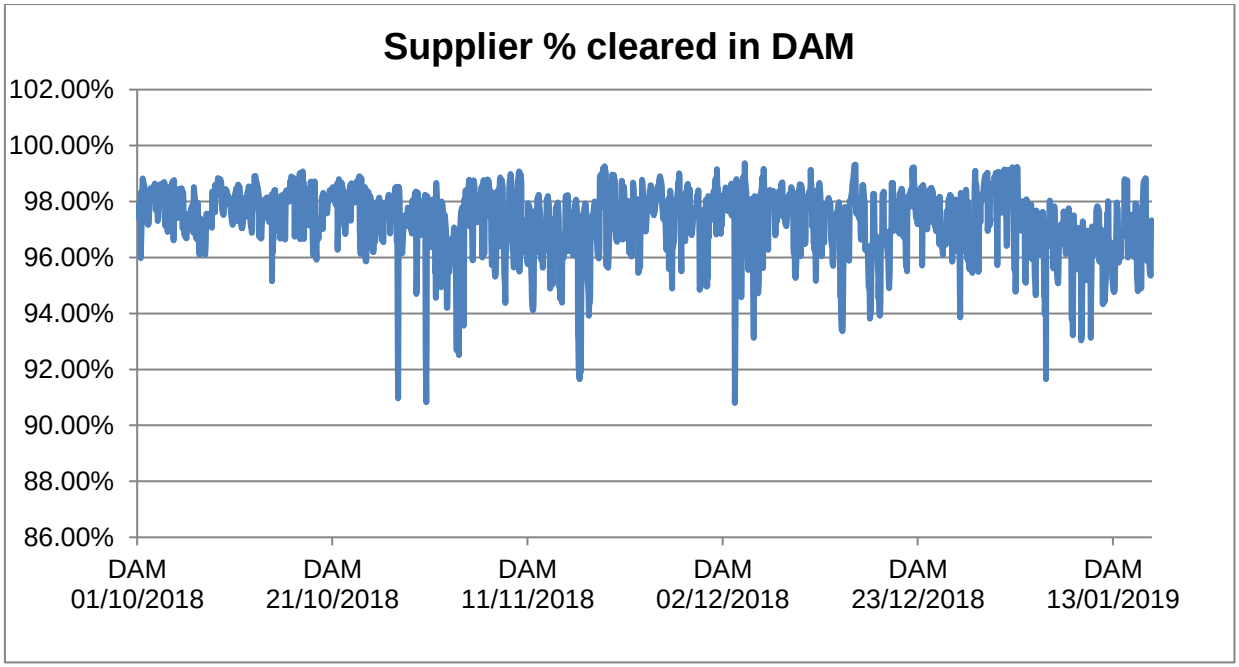

Figure 4: Supplier % cleared in Day Ahead Market

Non-Energy vs Energy Volumes

One of the primary risks outlined in the first studies carried out into the LNAF and SIFF values was the potential impact on constraint costs, or the costs of non-energy actions. A non-energy action can be defined as a balancing action taken by the TSO to move a unit away from its Ex Ante market position for system security reasons. An energy action can be defined as an action required to satisfy system demand that hasn't been met in the Ex Ante markets. The ratio of non-energy to energy action volumes is an important metric to determine the potential impact applying LNAF could have. This is because part of the intention is to apply the LNAF in situations where the energy imbalance is relatively high, while attempting not to increase the cost of non-energy actions. If there are situations where the energy action volumes are consistently greater than the non-energy volumes, then there would be a more clear case where the application of LNAFs should not overly impact the non-energy volumes. In this case, the times where this LNAF would apply would be periods where the energy volumes are high and therefore the ratio of non-energy to energy volumes low, and the times where the LNAF would not apply would be periods where the energy volumes are low and therefore the ratio high.

A comparison of the non-energy vs energy volumes was carried out to calculate a ratio of the volumes. The following assumptions were made to categorise volumes into energy and non-energy. The first item in the ratio was the absolute value of the Net Imbalance Volume in each half hour (i.e. netting all positive and negative quantities in an Imbalance Settlement Period to give the total residual volume which represents the energy imbalance and therefore total volume of energy balancing actions, then taking its absolute value). This was compared with the difference between the sum of the absolute value of all balancing action volumes and the Net Imbalance Volume (i.e. all negatives and positives were considered as positives, and with the volume of energy balancing actions taken away, this was intended to represent the volume of non-energy balancing actions). When considered on a net basis across the whole period of time from Oct 2018 – Jan 2019, and when considered on a net basis separately for each Trading Day within that period, the ratio of non-energy to energy actions was found to be consistently high, i.e. there are much greater volumes of non-energy actions taken than energy actions.

Comparing over the whole period, the ratio of non-energy to energy volumes was calculated as 3.49. A more suitable timeframe over which to consider the averaging of high and low ratios is over a Trading Day (see figure 5). While certain half hours may have high or low ratios, the LNAF is most effective when considered over a number of periods together, because the action an LNAF is trying to avoid of starting a long notice unit to meet an imbalance normally requires delivery of energy over a number of hours. If a day generally has high imbalances and low non-energy to energy ratio, there would be a good case to apply an LNAF in that day. This is one reason why SIFF considers a daily

imbalance value, and is set once a day. From the analysis carried out, there was a daily average ratio of 4.1 non-energy volumes to energy volumes, with a maximum daily ratio of 11.04 and a minimum of 0.9. With a moderately low Standard Deviation of 1.94, this indicates that the ratio of non-energy to energy volumes across a Trading Day is consistently high. Given this, the application of an LNAF at any level of imbalance would very likely have the unintended consequence of increasing the cost of the larger relative volume of non-energy actions in the market. This could lead to an increase in the Dispatch Balancing costs for the System Operator.

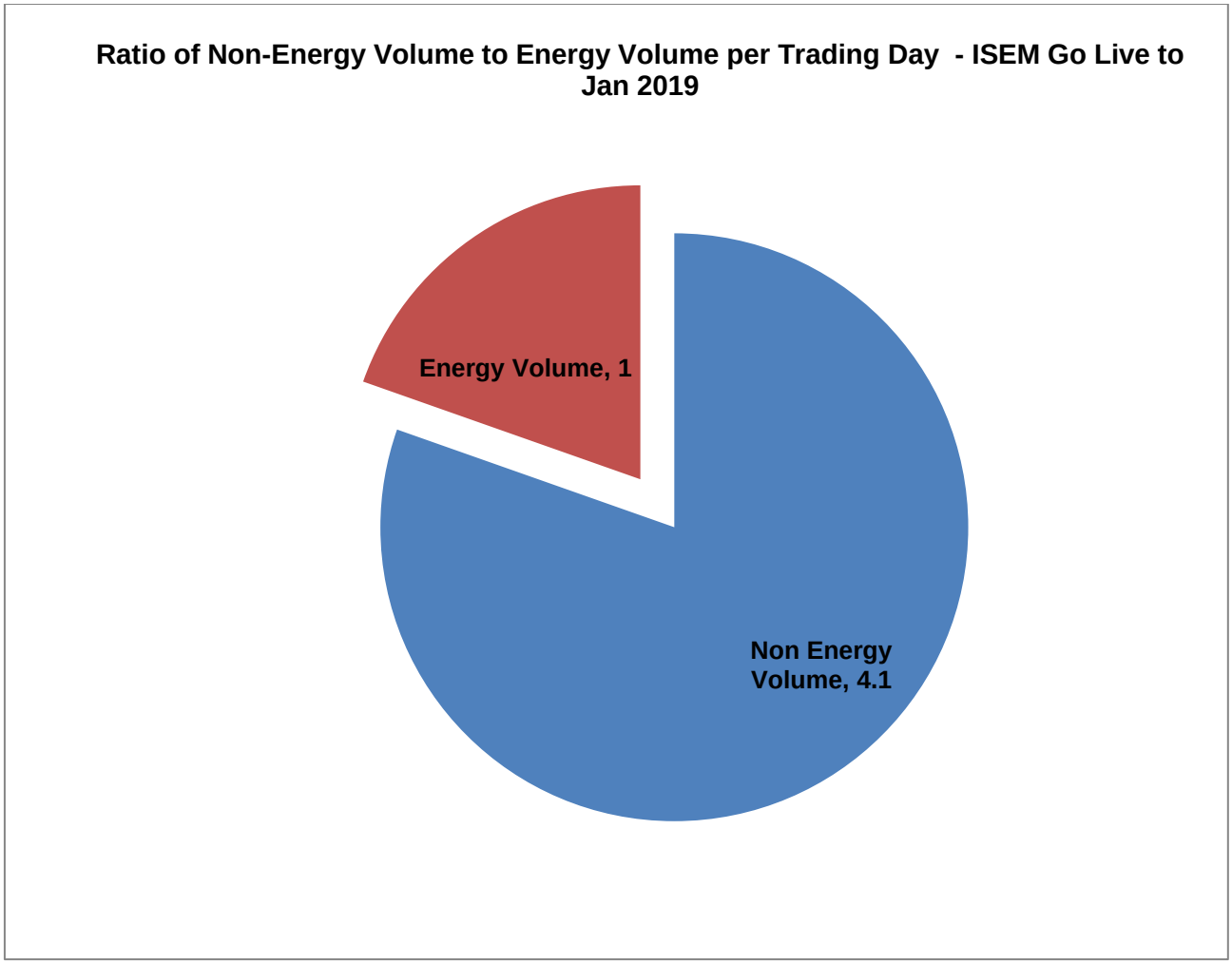

Figure 5: Ratio of Non-Energy volume to energy Volume

Early Actions

A main driver for implementing LNAF/SIFF is to avoid the propensity for early synchronisation of units by the System Operator. Based on operational data for dispatch instructions we have carried out analysis on the synchronisation instructions issue time compared to the scheduled effective time. As there is no specific criteria for defining how an early action by the system operator would be classified we can refer to the last time to instruct for a unit.

The last time to instruct for the system operator is the latest time the system operator can issue a sync instruction to a unit to be online at the required target scheduled MW. For example the 18:00 LTS run which is published at 20:00 shows a unit required at 06:00 the following morning. If the unit has a cold notification time of 7 hours the latest we can issue the sync to the unit is 23:00 so if the unit was issued a sync at 22:00 this would be calculated as being 1 hour in advance of the notification time (as shown on figures 6 and 7) or 1 hour “Early”.

This analysis was completed using the market technical offer data notification times for hot, warm and cold heat states. Figures 6 and 7 includes the synchronisation instructions for units (non-priority dispatch) on the island with notification times greater than 1 hour to capture units that would be affected by LNAF/SIFF. This represents ~7% of the total number of synchronisation dispatch instructions that were issued in the period from October 2018 to August 2019(Total of 5873 sync dispatches). As units can sometimes synchronise faster than their normal notification time (if for example they are on the border of a heat boundary), for the purposes of this analysis the units that synchronised faster than their normal market data were excluded.

It must be taken into account that as the granularity of the scheduling tool for Long Term Scheduling is 30 mins therefore the advisory time for issuing the synchronisation instruction is to the nearest 30 mins. It also needs to be considered that each LTS scheduling run, of which there are generally 6 per day, can take a number of hours to process. Operators need to be aware that while the next schedule may show a different unit commitment outcome that also waiting for the next schedule to complete may cause a unit to have passed its last time to instruct thus leaving that unit effectively unavailable. The risk associated with not having long notice units available needs to be considered by the System Operator and any associated impact on margin and replacement reserves which are discussed in a later chapter (Impact on Margin).

Out of a total of 5873 synchronisation instructions (covering all dispatchable units from Oct 2018 to Aug 2019) 98% were issued within 1 hour of the notification time or last time to instruct. As figure 6 and figure 7 show the majority of long notice synchronisation instructions (71%) were issued in the hour before the last time to instruct.

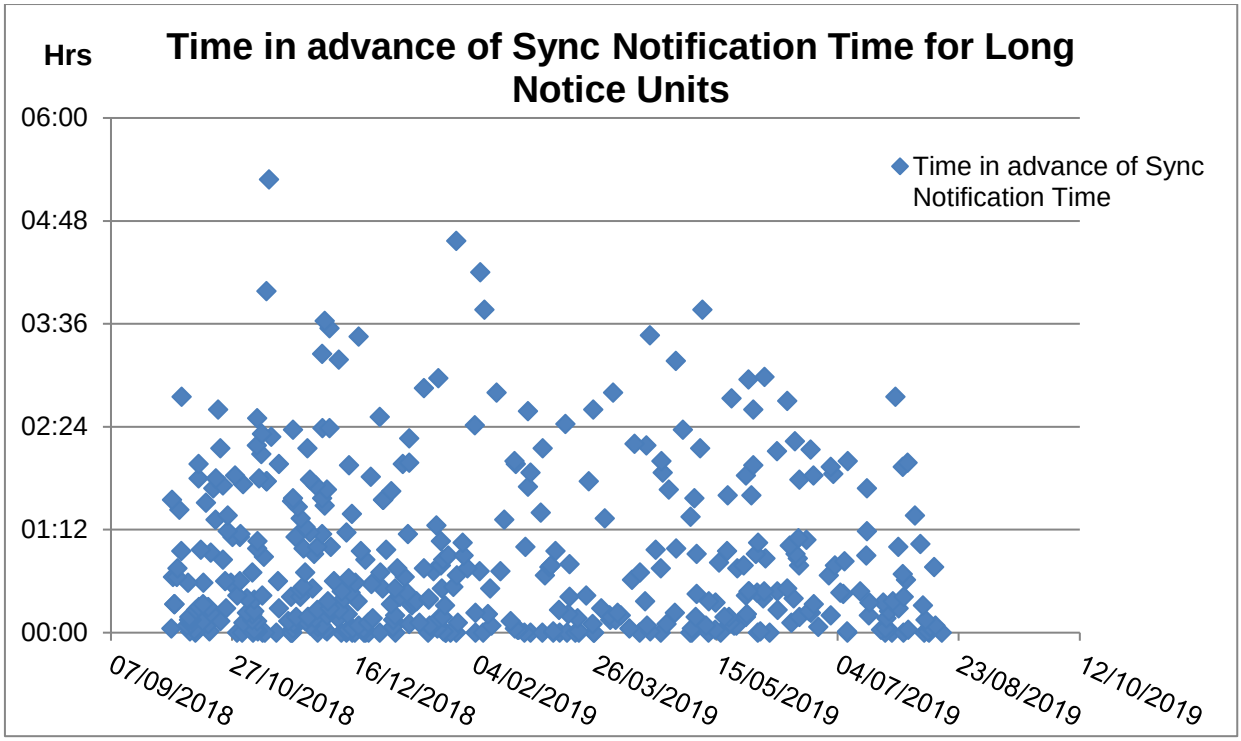

Figure 6: Sync times in advance of heat state dependent notification time

There were 3 instances where units were issued synchronisation instructions greater than 4 hours in advance of the notification time. In all 3 cases the units were in a cold heat state and were required on the system due to binding system constraints. In a case where there is a binding constraint on the system the unit may be sent a synchronisation instruction in advance of the notification time as further scheduling runs will not change the requirement for the unit.

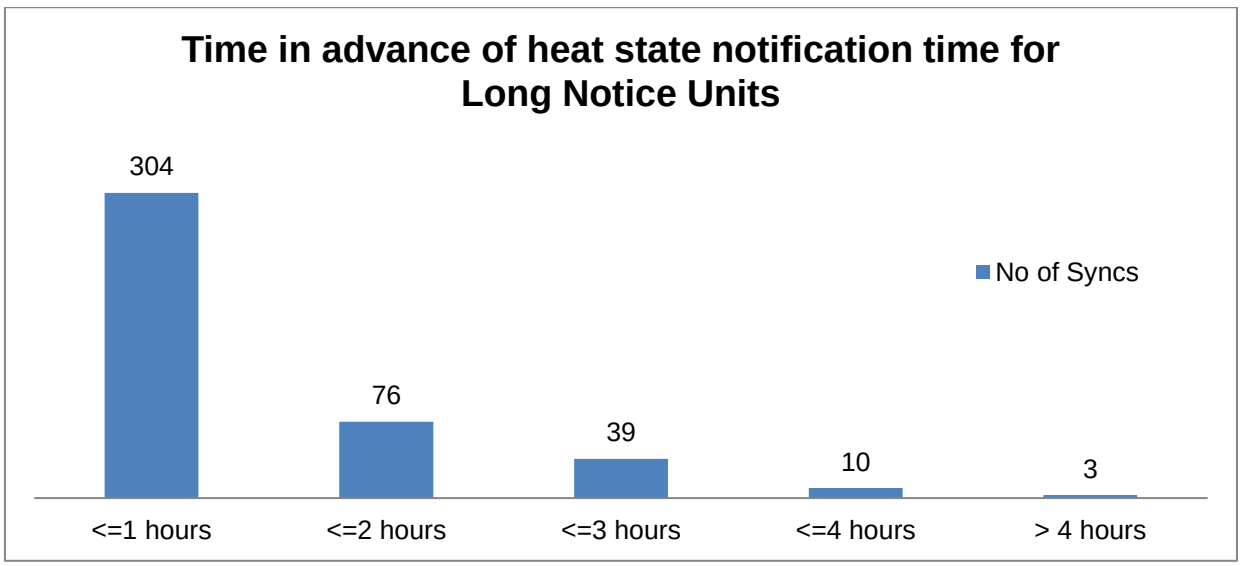

Figure 7: Frequency of syncs with respect to hours before notification time

Based on these results as shown in Figure 6 and 7 it seems that the balancing actions are been taken in a prudent manner whilst also ensuring that priority dispatch and system security are being maintained.

Scheduling considerations

Some further observations for consideration based on experience from operating the scheduling software since Go Live -

Effect on scheduler solve times with additional constraints - There is empirical evidence that increasing the costs of production of units (by weighting the startup costs) could lead to longer solve times that could have a detrimental effect on the timely production of operational schedules. It could also impact on the accuracy of the optimisation with larger MIP (mixed integer programming) gaps as the solver tries to decide between starting a large unit with a weighted startup cost versus breaching other constraints with penalty costs.
There is a balance to be struck between applying a weighting factor to startup costs and also solving all the other constraints in the optimization (Load, inertia, ROCOF, network contingencies, reserve, generator technical parameters etc). Also as different technologies are added to the scheduling system (e.g solar/battery) and reserve categories(e.g co-optimisation of FFR) there will be an additional burden on the solver in terms of the number of constraints which could directly affect the solve time. If LNAF were to be implemented the impact on the solve times for schedules would need to be assessed within current operational timelines.

Transparency of scheduling results/Market participants– a weighted factor for startup costs makes the interpretation of the scheduling results more difficult as the source of commercial offer data has been changed. Sanity checking of commitment decisions is based on checking the commercial offer data and other constraints for the unit (reserve provision etc). LNAF would make interpretation of the scheduler results more difficult as to the reason why a particular unit was being committed.

Interaction of Simple/Complex commercial offer data with LNAF adjusted complex data –
As detailed in the balancing market principle statement (BMPS) the Long Term Scheduler (LTS) and Real Time Commitment (RTC) both use complex commercial offer data. There is already a push pull scenario with the schedulers showing advisory syncs for short notice plant based on complex data. Then when it comes to dispatching these units we are looking at higher simple prices from our merit order. Increasing the startup costs of long notice plant would add another level of complexity here which may lead to a lack of transparency in our scheduling and dispatch decisions.

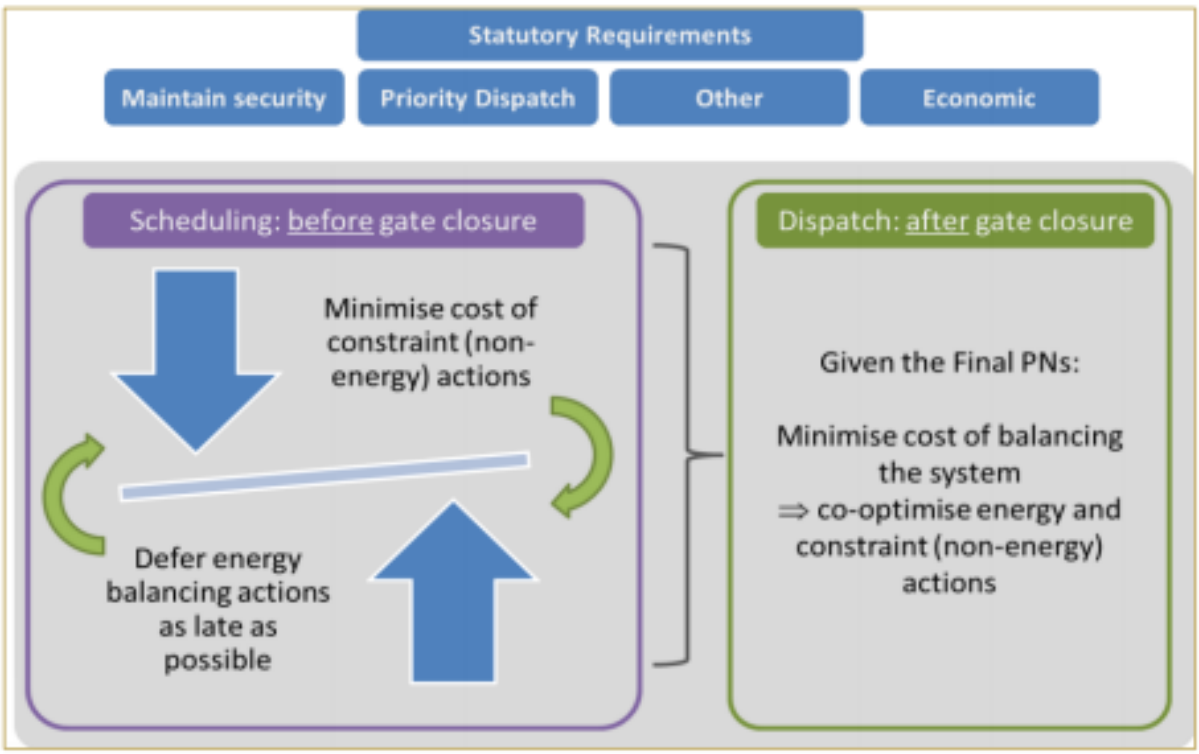

Figure 8: Illustration of balance between multiple objectives in single optimization

Figure 8 is an illustration that was shown as part of the original report into LNAF & SIFF and attempts to show the balance of statutory obligations and system security/economics.

Impact on Margin

As discussed in the previous report on LNAF and SIFF parameters there is an interaction between applying an increase in startup costs and the generation margin. The application of LNAFs will tend to utilise more short notice units to provide energy and reserve (replacing the energy and reserve provided by the longer notice units which are not scheduled to run) and so will tend to reduce the availability of spare short notice units. If the notification time passes for the longer notice units these units are now effectively unavailable for commitment in the scheduling tool.

The result is that during abnormal events it may not be possible to meet reserve requirements (reserve scarcity) and it may not be possible to meet all demand requirements (unserved energy).

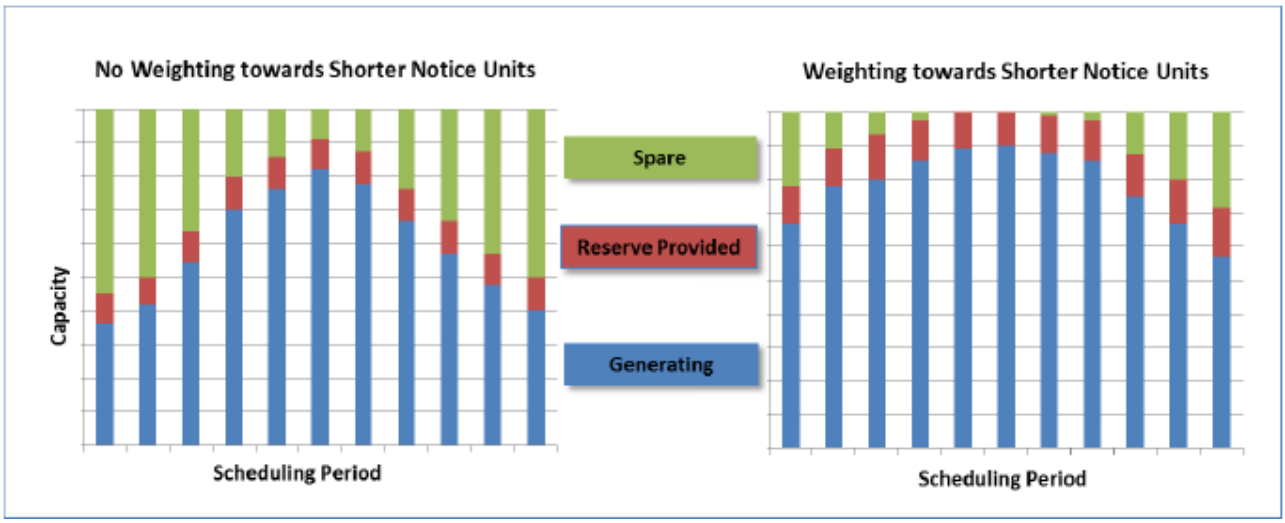

Figure 9: Illustration of Impact on Margin/Replacement Reserve for bias towards short notice plant using LNAF

As illlustrated in Figure 9 the amount of spare MW capacity from short notice fast acting plant will reduce if those units are already online for energy provision. This in turn will put pressure on meeting the replacement reserve requirements needed on the island.

Recommendation

The analysis presented on the operation of the balancing market since go-live suggests that it has not had a negative impact on trading in the intraday markets, given that a number of indicators seem to show relatively healthy liquidity in offers to sell relative to the bids to buy. The analysis also suggests that there is a relatively large risk of unintentionally increasing the cost of non-energy actions, even in periods with relatively high imbalance volumes, given that the volumes of these actions are consistently relatively much higher than the volumes of energy actions in each Trading Day.

Also taking into account the operational data showing that synchronisation instructions are being issued in a timely manner with respect to the heat state dependent notification times we believe that unnecessarily early dispatch actions have not been a feature of the balancing market since I-SEM Go Live in October 2018.

Therefore it is recommended that we continue not to utilise LNAF or SIFF functionality for 2020. In terms of the values which give rise to this, it would mean continuing to apply values of zero for LNAF and SIFF. For subsequent years if there are any changes to the metrics for determining whether the LNAF and SIFF are needed due to decreased relative liquidity in the intraday markets or decreased risk of increasing non-energy costs, then more detailed analysis of suitable values for LNAF and SIFF can be carried out.

Scheduling and Dispatch Policy Parameter	2018/2019 Values	Recommended Value for 2020
LNAF	0	0
SIFF	0	0

Acronyms

LNAF	Long Notice Adjustment Factor
SIFF	System Imbalance Flattening Factor
DAM	Day Ahead Market
IDA1	Intraday 1
IDA2	Intraday 2
IDA3	Intraday 3
IDC	Intraday Continuous
LTS	Long Term Schedule
RTC	Real Time Commitment
RTD	Real Time Dispatch
FFR	Fast Frequency Response
ROCOF	Rate Of Change Of Frequency
BMPS	Balancing Market Principles Statement
SSII	System Shortfall Imbalance Index